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# AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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# Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

## Key

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# AERONAUTICAL ENGINEERING

*A Continuing Bibliography (Suppl. 341)*

FEBRUARY 7, 1997

## 02
## AERODYNAMICS

*Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.*

**19970003682** NASA Ames Research Center, Moffett Field, CA USA

**Computational Investigation of Tangential Slot Blowing on a Generic Chined Forebody**

Agosta–Greenman, Roxana M., California Polytechnic State Univ., USA; Gee, Ken, MCAT Inst., USA; Cummings, Russell M., California Polytechnic State Univ., USA; Schiff, Lewis B., NASA Ames Research Center, USA; Journal of Aircraft; Aug. 1995; Volume 32, No. 4, pp. 811-817; In English; Atmospheric Flight Mechanics Conference, 1-2 Aug. 1994, Scottsdale, AR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCA2-626

Report No.(s): NASA-CR-202708; NAS 1.26:202708; AIAA Paper 94-3475; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

The effect of tangential slot blowing on the flowfield about a generic chined forebody at high angles of attack is investigated numerically using solutions of the thin-layer, Reynolds-averaged, Navier-Stokes equations. The effects of jet mass now ratios, angle of attack, and blowing slot location in the axial and circumferential directions are studied. The computed results compare well with available wind-tunnel experimental data. Computational results show that for a given mass now rate, the yawing moments generated by slot blowing increase as the body angle of attack increases. It is observed that greater changes in the yawing moments are produced by a slot located closest to the lip of the nose. Also, computational solutions show that inboard blowing across the top surface is more effective at generating yawing moments than blowing outboard from the bottom surface. Author

*Forebodies; Navier-Stokes Equation; Computational Fluid Dynamics; Tangential Blowing; Angle of Attack; Flow Distribution*

**19970003710** NASA Ames Research Center, Moffett Field, CA USA

**Evaluation of Turbulence Models for Unsteady Flows of an Oscillating Airfoil**

Srinivasan, G. R., JAI Associates, Inc., USA; Ekaterinaris, J. A., Naval Postgraduate School, USA; McCroskey, W. J., Army Aviation Systems Command, USA; Computers and Fluids; 1995; ISSN 0045-7930; Volume 24, No. 7, pp. 833-861; In English

Contract(s)/Grant(s): DAAL03-90-C-0013

Report No.(s): NASA-TM-111942; NAS 1.15:111942; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Unsteady flowfields of a two-dimensional oscillating airfoil are calculated using an implicit, finite-difference, Navier Stokes numerical scheme. Five widely used turbulence models are used with the numerical scheme to assess the accuracy and suitability of the models for simulating the retreating blade stall of helicopter rotor in forward flight. Three unsteady flow conditions corresponding to an essentially attached flow, light-stall, and deep-stall cases of an oscillating NACA 0015 wing experiment were chosen as test cases for computations. Results of unsteady airloads hysteresis curves, harmonics of unsteady pressures, and instantaneous flowfield patterns are presented. Some effects of grid density, time-step size, and numerical dissipation on the unsteady solutions relevant to the evaluation of turbulence models are examined. Comparison of unsteady airloads with experimental data show that all models tested are deficient in some sense and no single model predicts airloads consistently and in agreement with experiment for the three flow regimes. The chief findings are that the simple algebraic model based on the renormalization group theory (RNG) offers some improvement over the Baldwin Lomax model in all flow regimes with nearly same computational cost. The one-equation models provide significant improvement over the algebraic and the half-equation models but have their

own limitations. The Baldwin-Barth model overpredicts separation and underpredicts reattachment. In contrast, the Spalart-Allmaras model underpredicts separation and overpredicts reattachment.
Author
*Turbulence Models; Unsteady Flow; Flow Distribution; Finite Difference Theory; Navier-Stokes Equation; Computational Fluid Dynamics; Airfoils; Oscillations; Separated Flow; Aerodynamic Stalling*

**19970004298** North Carolina State Univ., Raleigh, NC USA
**Hypersonic Boundary-Layer Stability Experiments on a Flared-Cone Model at Angle of Attack in a Quiet Wind Tunnel** ***Final Report***
Doggett, Glen P., North Carolina State Univ., USA; Chokani, Ndaona, North Carolina State Univ., USA; Oct. 1996; 132p; In English
Contract(s)/Grant(s): NCC1-183; RTOP 505-59-50-02
Report No.(s): NASA-CR-201617; NAS 1.26:201617; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An experimental investigation of the effects of angle of attack on hypersonic boundary-layer stability on a flared-cone model was conducted in the low-disturbance Mach-6 Nozzle-Test Chamber Facility at NASA Langley Research Center. This unique facility provided a 'quiet' flow test environment which is well suited for stability experiments because the low levels of freestream 'noise' minimize artificial stimulation of flow-disturbance growth. Surface pressure and temperature measurements documented the adverse-pressure gradient and transition-onset location. Hot-wire anemometry diagnostics were applied to identify the instability mechanisms which lead to transition. In addition, the mean flow over the flared-cone geometry was modeled by laminar Navier-Stokes computations. Results show that the boundary layer becomes more stable on the windward ray and less stable on the leeward ray relative to the zero-degree angle-of-attack case. The second-mode instability dominates the transition process at a zero-degree angle of attack, however, on the windward ray at an angle of attack this mode was completely stabilized. The less-dominant first-mode instability was slightly destabilized on the windward ray. Non-linear mechanisms such as saturation and harmonic generation are identified from the flow-disturbance bispectra.
Author
*Angle of Attack; Aerodynamic Noise; Zero Angle of Attack; Boundary Layer Stability; Hypersonic Speed; Navier-Stokes Equation; Hypersonics; Aerodynamic Stability; Hypersonic Boundary Layer*

**19970004318** Air Force Inst. of Tech., Dept. of the Air Force; Air Univ., Wright-Patterson AFB, OH USA
**Experimental Investigation of a Supersonic Boundary Layer Including Favorable Pressure Gradient Effects**
Luker, Joel J., Air Force Inst. of Tech., USA; Dec. 19, 1995; 199p; In English
Report No.(s): AD-A306651; AFIT/GAE/ENY/95D-16; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This study used advanced laser Doppler velocimetry techniques to measure the turbulence intensities and Reynolds shear stresses in Mach 2.8 turbulent flat plate and Mach 2.9 favorable pressure gradient (FPG) boundary layers. The FPG was generated using a convex curved wall and had a strength of Beta = 0.1, where Beta is Clauser's equilibrium parameter. The maximum magnitude of the 'extra' strain rates normalized by the main strain rates was 0.1, which meant the FPG was considered to be a strong pressure gradient. The fiat plate results indicated that the LDV procedures used in this experiment prevented angular biasing of the velocity measurements reported in the literature. Analysis of the LDV system settings also showed that this biasing, which has been attributed in the past to the angular alignment of the lasers, may have actually been caused, at least in part, by the choice of record interval used during data collection. Measurements in the FPG test section demonstrated that the stabilizing effect of the FPG reduced the turbulence intensities below the location y/6 less than 0.5. Near the wall, the u-turbulence intensity was found to be reduced to 70% of the flat
DTIC
*Boundary Layers; Turbulence; Compressible Flow; Laser Doppler Velocimeters; Supersonic Boundary Layers; Velocity Measurement; Pressure Gradients; Angular Velocity*

**19970004323** Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA
**The Source and Evolution of Turbulence in Trailing Vortex Pairs** ***Final Report, Apr. 1995***
Vogel, Christine M., Virginia Polytechnic Inst. and State Univ., USA; Devenport, William J., Virginia Polytechnic Inst. and State Univ., USA; Apr. 1995; 256p; In English
Contract(s)/Grant(s): N00014-90-J-1909; N00014-91-J-1773
Report No.(s): AD-A306706; VPI-AOE-217; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The reanalysis of data obtained from the experimental studies of two different trailing vortex pairs has been conducted to obtain a more complete understanding of the turbulence structure of these flows. Statistical and spectral results, as well as filtered

results and estimates of the effects of vortex wandering on the characteristics of the flows are presented. The results of the vortex pair are compared with the data from the experimental study of an isolated vortex conducted under similar testing conditions and model configuration to distinguish between the structure and effects of the separate vortices from those of vortex interaction. The analysis of a counter-rotating vortex pair reveals that initially the vortices develop in a manner similar to an isolated vortex. The cores appear laminar and the turbulence structure outside them is dominated by the spiral wakes. After some distance, flow inside and outside the cores becomes much more turbulent. The cores begin to grow and decay. The results indicate that this change may be a result of wave instabilities developed in the cores. The analysis of the co-rotating vortex pair reveal that turbulence is present in the cores as they spiral about each other and move downstream. After a certain distance, the cores merge into a single core, which contains more turbulence and is over twice the size of the pair that created it. As merger comes to completion, a symmetric core is formed which has much less turbulence. Merger appears to cause an increased rate of vortex decay.
DTIC
*Turbulence; Flow Characteristics; Counter Rotation; Stability; Rotation; Wakes; Vortices*

**19970004382** National Aeronautics and Space Administration. Langley Research Center, Hampton, VA USA
**Multigrid Approach to Incompressible Viscous Cavity Flows**
Wood, William A., National Aeronautics and Space Administration. Langley Research Center, USA; May 1996; 16p; In English
Contract(s)/Grant(s): RTOP 242-80-01-01
Report No.(s): NASA TM-110262; NAS 1.15:110262; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two-dimensional incompressible viscous driven-cavity flows are computed for Reynolds numbers on the range 100-20,000 using a loosely coupled, implicit, second-order centrally-different scheme. Mesh sequencing and three-level V-cycle multigrid error smoothing are incorporated into the symmetric Gauss-Seidel time-integration algorithm. Parametrics on the numerical parameters are performed, achieving reductions in solution times by more than 60 percent with the full multigrid approach. Details of the circulation patterns are investigated in cavities of 2-to-1, 1-to-1, and 1-to-2 depth to width ratios.
Author
*Viscous Flow; Cavities; Two Dimensional Flow; Computation*

**19970004474** Stanford Univ., Dept. of Aeronautics and Astronautics, CA USA
**Application of Particle Image Velocimetry to a Study of Flow About a Multi-Element Airfoil** ***Final Report, 15 Aug. 1995 - 14 Aug. 1996***
Walker, Stephen M., Stanford Univ., USA; Baganoff, Donald, Stanford Univ., USA; Nov. 14, 1996; 35p; In English
Contract(s)/Grant(s): NCC2-5155
Report No.(s): NASA-CR-202724; NAS 1.26:202724; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment was performed on the flap tip vortex shed from a half span Fowler flap. This flap was mounted on a 5 foot span NACA 63(2)-215 Mod B airfoil in the 7 by 10 foot wind tunnel at NASA Ames Research Center. Several noise reduction studies were performed with this model, and the addition of the Particle Image Velocimetry (PIV) research discussed here served as a proof case of large scale PIV. The measurement plane investigated here was a cross plane region. This is cross plane relative to the freestream flow direction. The measurement plane was located at a position 18 inches downstream of the flap trailing edge. This served to prove that measurements could also be made in the more difficult cross plane direction rather than in the downstream flow direction. Lastly the PIV data was used as a practical research tool that yielded important results that could not otherwise be obtained. The flow field area measured was 40 cm by 40 cm square, and served to characterize the downstream flow characteristics of the flap tip vortex under three configurations: the baseline configuration which was the flap and the wing only; the baseline with the addition of a 3/4 span slat; and the baseline with a Flap Edge Device which was designed to reduce the noise generated at the flap. All configurations were tested at a freestream velocity of 64.84 m/s. The test resulted in average velocity fields for the three configurations tested. The velocity fields aided in verifying other testing methods on this particular experiment, and also yielded further insight into the characteristics of the flap tip vortex under the three configurations considered. The velocity data was reduced, and we were able to calculate the vorticity of the flow field. From the position of minimum vorticity the location of the center of the vortex was determined. The circulation was also calculated and aided in comparing the effects of the three configurations on the lifting characteristics of the flap.
Author
*Particle Image Velocimetry; Wind Tunnel Tests; Vortices; Flow Distribution; Flow Measurement; Trailing Edge Flaps*

## 03
## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; and aircraft accidents.*

**19970003560** Toledo Univ., Dept. of Chemical Engineering, OH USA
**Numerical Simulation of Internal Heat Transfer Phenomena Occurring During De-Icing of Aircraft Components** ***Final Report, 6 Oct. 1995 - 30 Sep. 1996***
DeWitt, Keneth J., Toledo Univ., USA; Sep. 30, 1996; 11p; In English
Contract(s)/Grant(s): NAG3-1796
Report No.(s): NASA-CR-202720; NAS 1.26:202720; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental study to determine the convective heat transfer coefficient from castings made from ice-roughened plates is reported. A corresponding topic, 'Measurements of the Convective Heat Transfer Coefficient from Ice Roughened Surfaces in Parallel and Accelerated Flows,' is presented.
Derived from text
*Convective Heat Transfer; Heat Transfer Coefficients; Surface Roughness; Win d Tunnel Tests; Mathematical Models; Reynolds Number; Stanton Number; Ice Formation*

**19970003565** NASA Ames Research Center, Moffett Field, CA USA
**A System Concept for Facilitating User Preferences in En Route Airspace**
Vivona, R. A., Sterling Software, Inc., USA; Ballin, M. G., NASA Ames Research Center, USA; Green, S. M., NASA Ames Research Center, USA; Bach, R. E., NASA Ames Research Center, USA; McNally, B. D., NASA Ames Research Center, USA; Nov. 1996; 30p; In English
Contract(s)/Grant(s): RTOP 505-64-36
Report No.(s): NASA TM-4763; NAS 1.15:4763; A-962788; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Aviation Administration is trying to make its air traffic management system more responsive to the needs of the aviation community by exploring the concept of 'free flight' for aircraft flying under instrument flight rules. A logical first step toward free flight could be made without significantly altering current air traffic control (ATC) procedures or requiring new airborne equipment by designing a ground-based system to be highly responsive to 'user preference' in en route airspace while providing for an orderly transition to the terminal area. to facilitate user preference in all en route environments, a system based on an extension of the Center/TRACON Automation System (CTAS) is proposed in this document. The new system would consist of two integrated components. An airspace tool (AT) focuses on unconstrained en route aircraft (e.g., not transitioning to the terminal airspace), taking advantage of the relatively unconstrained nature of their flights and using long-range trajectory prediction to provide cost-effective conflict resolution advisories to sector controllers. A sector tool (ST) generates efficient advisories for all aircraft, with a focus on supporting controllers in analyzing and resolving complex, highly constrained traffic situations. When combined, the integrated AT/ST system supports user preference in any air route traffic control center sector. The system should also be useful in evaluating advanced free-flight concepts by serving as a test bed for future research. This document provides an overview of the design concept, explains its anticipated benefits, and recommends a development strategy that leads to a deployable system.
Author
*Air Traffic Control; User Requirements; Management Systems; Automatic Control; Free Flight*

## 04
## AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.*

**19970003794** Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA
**An Analysis of TRACON (Terminal Radar Approach Control) Controller - Pilot Voice Communications** ***Final Report***
Cardosi, Kim M., Federal Aviation Administration, USA; Brett, Bryan, Federal Aviation Administration, USA; Han, Sherwin, Federal Aviation Administration, USA; Jun. 1996; 35p; In English
Report No.(s): AD-A313942; DOT/VNTSC-FAA-96-7; DOT/FAA/AR-96/66; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this analysis was to examine pilot-controller communication practices in the TRACON (Terminal Radar Approach Control) environment. Forty-eight hours of communications recorded on the voice tapes from eight TRACONs were analyzed. There were 13,089 controller-to-pilot transmissions examined in this study. This included 9,409 clearances (e.g., assignment of attitude; instructions to change heading, speed, or radio frequencies; instructions for arrival, etc.) and 3,680 requests for information, salutations, etc. The complexity of the controller's message (i.e., the number of pieces of information) was examined and the number of erroneous readbacks were analyzed as a function of message complexity. Pilot acknowledgments were also analyzed; the numbers of full and partial readbacks, and acknowledgments only (i.e., 'roger') were tallied. Pilot reports of altitude information was also examined. Fewer than one percent of the messages resulted in communications errors. Among the error factors examined were: complexity of the message, type of acknowledgment, use of call sign in the acknowledgment, type of information in error, and whether or not the controller responded to the readback error. Instances in which the controller contacted the aircraft with one call sign and the pilot acknowledged the transmission with another call sign were also examined. The report concludes with recommendations to further reduce the probability of communication errors.
DTIC
*Air Traffic Controllers (Personnel); Messages; Attitude (Inclination); Radar Approach Control; Voice Communication; Terminal Guidance; Clearances; Pilots (Personnel)*

**19970004326** Western Aerospace Labs., Inc., Monte Sereno, CA USA
**Building the Traffic, Navigation, and Situation Awareness System (T-NASA) for Surface Operations** ***Final Report, Aug. 1995 - Oct. 1996***
McCann, Robert S., Western Aerospace Labs., Inc., USA; Oct. 1996; 14p; In English
Contract(s)/Grant(s): NCC2-818
Report No.(s): NASA-CR-203032; NAS 1.26:203032; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We report the results of a part-task simulation evaluating the separate and combined effects of an electronic moving map display and newly developed HUD symbology on ground taxi performance, under moderate- and low-visibility conditions. Twenty-four commercial airline pilots carried out a series of 28 gate-to-runway taxi trials at Chicago O'Hare. Half of the trials were conducted under moderate visibility (RVR 1400 ft), and half under low visibility (RVR 700 ft). In the baseline condition, where navigation support was limited to surface features and a Jeppesen paper map, navigation errors were committed on almost half of the trials. These errors were virtually abolished when the electronic moving map or the HUD symbology was available; in addition, compare, the baseline condition, both forms of navigation aid yielded an increase in forward taxi speed. The speed increase was greater for HUD than the electronic moving map, and greater under low visibility than under moderate visibility. These results suggest that combination of electronic moving map and HUD symbology has the potential to greatly increase the efficiency of ground operations, particularly under low-visibility conditions.
Author
*Navigation Aids; Air Traffic; Commercial Aircraft; Civil Aviation*

## 05
## AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes aircraft simulation technology.*

**19970003416** NASA Ames Research Center, Moffett Field, CA USA
**Wing Leading Edge Joint Laminar Flow Tests**
Drake, Aaron, Washington State Univ., USA; Westphal, Russell V., Washington State Univ., USA; Zuniga, Fanny A., NASA Ames Research Center, USA; Kennelly, Robert A., Jr., NASA Ames Research Center, USA; Koga, Dennis J., NASA Ames Research Center, USA; Oct. 1996; 38p; In English
Contract(s)/Grant(s): RTOP 505-59-20
Report No.(s): NASA-TM-4762; NAS 1.15:4762; A-962704; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
An F-104G aircraft at NASA's Dryden Flight Research Center has been equipped with a specially designed and instrumented test fixture to simulate surface imperfections of the type likely to be present near the leading edge on the wings of some laminar flow aircraft. The simulated imperfections consisted of five combinations of spanwise steps and gaps of various sizes. The unswept fixture yielded a pressure distribution similar to that of some laminar flow airfoils. The experiment was conducted at cruise conditions typical for business jets and light transports: Mach numbers were in the range 0.5-0.8, and unit Reynolds numbers were 1.5-2.5 million per foot. Skin friction measurements indicated that laminar flow was often maintained for some distance down-

stream of the surface imperfections. Further work is needed to more precisely define transition location and to extend the experiments to swept-wing conditions and a broader range of imperfection geometries.
Author
*Leading Edges; Laminar Flow; Wings; Surface Roughness*

**19970003578** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, Dept. of Aerodynamics., Jiangsu, China
**Method of Evaluating Aircraft Torsional Agility Metric using Pilot Transfer Function Model**
Huang, Pengnian, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Transactions of Nanjing University of Aeronautics and Astronautics; May 1994; Volume 11, No. 1, pp. 13-17; In English; Also announced as 19970003575; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The purpose of this paper is to calculate the torsional agility metric, the time-to-roll and capture a 90 deg bank angle change, using a simple pilot mathematical model obtained from simulator test. The metric mentioned above is determined by the aircraft maneuverability and controllability, or the pilot ability to roll and capture quickly and accurately a bank angle. Therefore, the time-to-roll and capture a 90 deg bank angle change can be obtained by calculating the open loop process with limited maximum stick deflect velocity and the man-machine closed loop precise tracking control. Results show that the calculated values are quite consistent with the manned simulation data. The deterioration of torsional agility while the aircraft is poor or very maneuverable can be explained. It is suggested that this approach could provide the basis for the approximate evaluation of aircraft torsional agility metric.
Author
*Mathematical Models; Controllability; Maneuverability; Feedback Control; Roll; Aircraft Control*

**19970003579** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, Dept. of Aircraft Engineering., Jiangsu, China
**A Method for Calculating Kinematic Parameters of Helicopter in Loop and Roll Maneuvers**
Cao, Yihua, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Gao, Zheng, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Transactions of Nanjing University of Aeronautics and Astronautics; May 1994; Volume 11, No. 1, pp. 18-26; In English; Also announced as 19970003575; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

A set of generalized equations which govern the kinematic parameters of helicopters in maneuvering flight is given. Loop and roll maneuvers are specially analyzed in detail and the sample calculations are presented. The method established in this paper is of practical significance for aerobatic employment and design of armed helicopters.
Author
*Helicopters; Mathematical Models; Aircraft Maneuvers; Maneuverability; Kinematics*

**19970003675** Boeing Commercial Airplane Co., Seattle, WA USA
**Advanced Configurations for Very Large Subsonic Transport Airplanes**
McMasters, John H., Boeing Commercial Airplane Co., USA; Paisley, David J., Boeing Commercial Airplane Co., USA; Hubert, Richard J., Boeing Commercial Airplane Co., USA; Kroo, Ilan, Stanford Univ., USA; Bofah, Kwasi K., Tuskegee Inst., USA; Sullivan, John P., Purdue Univ., USA; Drela, Mark, Massachusetts Inst. of Tech., USA; Oct. 1996; 60p; In English
Contract(s)/Grant(s): NAS1-20269; RTOP 505-90-59-05
Report No.(s): NASA-CR-201614; NAS 1.26:198351; D6-81724; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recent aerospace industry interest in developing a subsonic commercial transport airplane with 50 percent greater passenger capacity than the largest existing aircraft in this category (the Boeing 747-400 with approximately 400-450 seats) has generated a range of proposals based largely on the configuration paradigm established nearly 50 years ago with the Boeing B-47 bomber. While this basic configuration paradigm has come to dominate subsonic commercial airplane development since the advent of the Boeing 707/Douglas DC-8 in the mid-1950's, its extrapolation to the size required to carry more than 600-700 passengers raises several questions. to explore these and a number of related issues, a team of Boeing, university, and NASA engineers was formed under the auspices of the NASA Advanced Concepts Program. The results of a Research Analysis focused on a large, unconventional transport airplane configuration for which Boeing has applied for a patent are the subject of this report. It should be noted here that this study has been conducted independently of the Boeing New Large Airplane (NLA) program, and with the exception of some generic analysis tools which may be common to this effort and the NLA (as will be described later), no explicit Boeing NLA data other than that published in the open literature has been used in the conduct of the study reported here.
Author
*Commercial Aircraft; Transport Aircraft; Aircraft Configurations; Research*

**19970003714** Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
**Flight Test Update - F/A-18E/F Super Hornet (Slides)**
Gurney, T. C., Naval Air Warfare Center, USA; Sandberg, Jim, Naval Air Warfare Center, USA; Mar. 14, 1996; 39p; In English
Report No.(s): AD-A307877; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This presentation shows a background of the F/A-18 Super Hornet. Some background information includes: Program history, aircraft description, flight test program and the lessons noted.

DTIC
*Flight Tests; Attack Aircraft; F-18 Aircraft; Jet Aircraft*

**19970004300** Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia
**Sensitivity Study of an AMRL Finite Element Model of the F-111 Lower Wing Skin Structural Detail at Forward Auxiliary Spar Station (FASS) 281.28**
Keeley, D., Defence Science and Technology Organisation, Australia; Callinan, R., Defence Science and Technology Organisation, Australia; Sanderson, S., Defence Science and Technology Organisation, Australia; Sep. 1996; 18p; In English
Report No.(s): DSTO-TN-0060; AR-009-909; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

A baseline three-dimensional Finite Element (FE) model has been developed for a structural detail on an F-111 lower wing skin at Forward Auxiliary Spar Station (FASS) 281.28. This location has been the site of cracking in both RAAF and USAF aircraft. The FE model was developed using precise thickness measurements appropriate for a specific full-scale test wing available at AMRL (serial number A10-824). This document is a sensitivity study of the finite element model. The effects of small dimensional changes falling within the range of the manufacturing tolerances are investigated. This will allow a quantitative assessment of the stress variations which could be expected at that location within the F-111 fleet.

Author
*Finite Element Method; F-111 Aircraft; Wings*

## 07
## AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.*

**19970003474** RAND Corp., Santa Monica, CA USA
**Multipoint Aerial Refueling. A Review and Assessment**
Killingsworth, Paul S., RAND Corp., USA; Jan. 1996; 98p; In English
Contract(s)/Grant(s): DASW01-95-C-0059
Report No.(s): AD-A314032; ISBN-0-8330-2378-0; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The USA Air Force currently relies principally on boom-and- receptacle technology to conduct aerial-refueling operations for fixed-wing aircraft. With this approach, a single aircraft at a time may be refueled behind a tanker. An al ternative concept, called multipoint aerial refueling, uses probe-and-drogue technology to enable more than one fighter aircraft to aerially refuel simultaneously from a tanker. Advocates of a transition to multipoint aerial refueling describe multipoint's benefits as follows: greater flexibility and interoperability of U.S. forces, and the possibility of budgetary savings resulting from the smaller tanker inventory that could be required. Several studies in recent years have addressed the efficacy of multipoint aerial refueling for fighter-employment operations. Not surprisingly, since each study used different analytic approaches and assumptions, the results of the studies have varied. I reviewed five of these studies to understand the reasons for the differences among them and to determine whether any general conclusions could be drawn about the desirability of equipping U.S. tanker aircraft with the multipoint aerial-refueling capability.

DTIC
*Air to Air Refueling; Fighter Aircraft; Tanker Aircraft; Inventories; Fixed Wings; Aircraft Configurations*

**19970003552** NASA Dryden Flight Research Center, Edwards, CA USA
**Flight and Static Exhaust Flow Properties of an F110-GE-129 Engine in an F-16XL Airplane During Acoustic Tests**
Holzman, Jon K., NASA Dryden Flight Research Center, USA; Webb, Lannie D., NASA Dryden Flight Research Center, USA; Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Nov. 1996; 30p; In English
Contract(s)/Grant(s): RTOP 505-68-10

Report No.(s): NASA-TM-104326; H-2122; NAS 1.15:104326; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The exhaust flow properties (mass flow, pressure, temperature, velocity, and Mach number) of the F110-GE-129 engine in an F-16XL airplane were determined from a series of flight tests flown at NASA Dryden Flight Research Center, Edwards, California. These tests were performed in conjunction with NASA Langley Research Center, Hampton, Virginia (LARC) as part of a study to investigate the acoustic characteristics of jet engines operating at high nozzle pressure conditions. The range of interest for both objectives was from Mach 0.3 to Mach 0.9. NASA Dryden flew the airplane and acquired and analyzed the engine data to determine the exhaust characteristics. NASA Langley collected the flyover acoustic measurements and correlated these results with their current predictive codes. This paper describes the airplane, tests, and methods used to determine the exhaust flow properties and presents the exhaust flow properties. No acoustics results are presented.

Author

*Jet Engines; Exhaust Gases; Mass Flow Rate; Mach Number; Flight Tests; Flow Characteristics; Pressure Measurement; Velocity Measurement; Temperature Measurement*

**19970004332** Naval Postgraduate School, Monterey, CA USA

**The Instrumentation Design and Control of a T63-A-700 Gas Turbine Engine**

Hass, David Williams, Naval Postgraduate School, USA; Jun. 1996; 141p; In English

Report No.(s): AD-A313333; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A T63-A-700 gas turbine engine has been instrumented to measure performance parameters. Pressure and temperature monitoring systems have been designed, fabricated, and installed to ensure accurate measurement of performance parameters. All measured parameters have been compared against predicted thermodynamic cycle analysis. Design and control of selected engine systems have been modified to incorporate more precise engine control and safety.

DTIC

*Gas Turbine Engines; Thermodynamic Cycles; Engine Control*

**19970004568** Naval Postgraduate School, Monterey, CA USA

**Computer Simulation of an Unmanned Aerial Vehicle Electric Propulsion System**

Yourkoski, Joel, Naval Postgraduate School, USA; Mar. 1996; 122p; In English

Report No.(s): AD-A307294; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

There has been a substantial increase in the use of electric propulsion systems in Unmannned Aerial Vehicles (UAVs). However, this area of engineering has lacked the benefits of a dynamic model that could be used to optimize the design. configurations and flight profiles. The Naval Research Laboratory (NRL) has accurate models for the aerodynamics associated with UAVs. Therefore the proposed electric propulsion model would use the torque and RPM requirements generated by the aerodynamic model and provide an accurate representation of the desired UAV electric propulsion system. This thesis reports on the development of such a model. The model is adaptive in the sense that motor and battery parameters can be altered by the user to reflect systems currently in use or those considered for future systems. Not only will the simulation model accurately reflect the operating conditions of the motor and battery during the mission, but different flight profiles with the same configuration can be evaluated in terms of efficiency based on the Percent Battery Capacity Used (PBCU) at the end of the mission. This Electric Propulsion Simulator is part of a larger NRL project intended to design and deliver UAVs to the Naval Service over the next few years.

DTIC

*Computerized Simulation; Systems Engineering; Aircraft Models; Electric Propulsion*

## 08
## AIRCRAFT STABILITY AND CONTROL

*Includes aircraft handling qualities; piloting; flight controls; and autopilots.*

**19970003660** Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

**Summary of Advanced Infrared Guided Air-to-Air Missile Technology**

Tian, Zhenhua; Aero Weaponry; Jul. 18, 1996; N0. 5, pp. 11-16; In English

Report No.(s): AD-A313291; NAIC-ID(RS)T-0390-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article is divided into two sections. The first section gives a brief introduction to the characteristics of future aerial targets, and the second describes eight aspects of the advanced technology that future infrared guided air-to-air missiles may use.

DTIC

*Air to Air Missiles; Infrared Imagery; Technology Assessment; Target Recognition*

**19970004404** National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, CA USA
**Flight Evaluation of an Aircraft with Side and Center Stick Controllers and Rate-Limited Ailerons**
Deppe, P. R., Calspan Advanced Technology Center, USA; Chalk, C. R., Calspan Advanced Technology Center, USA; Shafer, M. F., National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, USA; Nov. 1996; 154p; In English
Contract(s)/Grant(s): RTOP 505-64-30
Report No.(s): NASA-CR-198055; NAS 1.26:198055; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

As part of an ongoing government and industry effort to study the flying qualities of aircraft with rate-limited control surface actuators, two studies were previously flown to examine an algorithm developed to reduce the tendency for pilot-induced oscillation when rate limiting occurs. This algorithm, when working properly, greatly improved the performance of the aircraft in the first study. In the second study, however, the algorithm did not initially offer as much improvement. The differences between the two studies caused concern. The study detailed in this paper was performed to determine whether the performance of the algorithm was affected by the characteristics of the cockpit controllers. Time delay and flight control system noise were also briefly evaluated. An in-flight simulator, the Calspan Learjet 25, was programmed with a low roll actuator rate limit, and the algorithm was programmed into the flight control system. Side- and center-stick controllers, force and position command signals, a rate-limited feel system, a low-frequency feel system, and a feel system damper were evaluated. The flight program consisted of four flights and 38 evaluations of test configurations. Performance of the algorithm was determined to be unaffected by using side- or center-stick controllers or force or position command signals. The rate-limited feel system performed as well as the rate-limiting algorithm but was disliked by the pilots. The low-frequency feel system and the feel system damper were ineffective. Time delay and noise were determined to degrade the performance of the algorithm.
Author
*Flight Control; Lear Jet Aircraft; Pilot Induced Oscillation; Time Dependence; Algorithms*

**19970004545** NASA Dryden Flight Research Center, Edwards, CA USA
**X-29A Lateral-Directional Stability and Control Derivatives Extracted From High-Angle-of-Attack Flight Data**
Iliff, Kenneth W., NASA Dryden Flight Research Center, USA; Wang, Kon–Sheng Charles Wang, Sparta, Inc., USA; Dec. 1996; 41p; In English
Contract(s)/Grant(s): RTOP 505-68-50
Report No.(s): NASA-TP-3664; NAS 1.60:3664; H-2118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The lateral-directional stability and control derivatives of the X-29A number 2 are extracted from flight data over an angle-of-attack range of 4 degrees to 53 degrees using a parameter identification algorithm. The algorithm uses the linearized aircraft equations of motion and a maximum likelihood estimator in the presence of state and measurement noise. State noise is used to model the uncommanded forcing function caused by unsteady aerodynamics over the aircraft at angles of attack above 15 degrees. The results supported the flight-envelope-expansion phase of the X-29A number 2 by helping to update the aerodynamic mathematical model, to improve the real-time simulator, and to revise flight control system laws. Effects of the aircraft high gain flight control system on maneuver quality and the estimated derivatives are also discussed. The derivatives are plotted as functions of angle of attack and compared with the predicted aerodynamic database. Agreement between predicted and flight values is quite good for some derivatives such as the lateral force due to sideslip, the lateral force due to rudder deflection, and the rolling moment due to roll rate. The results also show significant differences in several important derivatives such as the rolling moment due to sideslip, the yawing moment due to sideslip, the yawing moment due to aileron deflection, and the yawing moment due to rudder deflection.
Author
*Lateral Stability; X-29 Aircraft; Angle of Attack; Algorithms; Directional Stability; Parameter Identification; Directional Control; Lateral Control*

## 09
## RESEARCH AND SUPPORT FACILITIES (AIR)

*Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.*

**19970003773** Federal Aviation Administration, Airport and Aircraft Safety; Research and Development Div., FAA Technical Center., Washington, DC USA
**JAA Airport Lighting System Requirements Simulator Evaluation**
Katz, Eric S., Federal Aviation Administration, USA; Apr. 1996; 47p; In English

Report No.(s): AD-A307705; DOT/FAA/AR-TN95/11343035; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The European Joint Aviation Authority (JAA) introduced its Joint Airworthiness Requirements for Operations (JAR-OPS1) in April 1995. In general the airport lighting system requirements and associated operating minima authorized by the JAA for use during low-visibility takeoff and landing operations are lower than that used by the USA (U.S.) and American air carrier operators. The rationale for JAA's lower operating minima is based primarily on several years of operating experience by various European ICAO member states. In an effort to standardize aircrew procedures, training, and charting requirements, both the Federal Aviation Administration (FAA) and the JAA would like to harmonize low-visibility operating requirements and minima to the maximum extent possible. This report describes a simulator evaluation to determine the feasibility of adopting the JAA lighting system requirements and operating minima as the FAA standard for low-visibility operations. The data results from this evaluation will be used by FAA Headquarters to formulate the U.S. position on adopting the JAA operational requirements for low-visibility operations.

DTIC

*Flight Simulators; Low Visibility; Air Transportation; Lighting Equipment; Standardization*

**19970004275** NASA Langley Research Center, Hampton, VA USA

**Dynamic Stability Instrumentation System (DSIS), Volume 3, User Manual**

Daniels, Taumi S., NASA Langley Research Center, USA; Boyden, Richmond P., NASA Langley Research Center, USA; Dress, David A., NASA Langley Research Center, USA; Jordan, Thomas L., NASA Langley Research Center, USA; Sep. 1996; 78p; In English

Contract(s)/Grant(s): RTOP 505-59-54-01

Report No.(s): NASA-TM-109156; NAS 1.15:109156; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The paper is an operating manual for the Dynamic Stability Instrumentation System in specific NASA Langley wind tunnels. The instrumentation system performs either a synchronous demodulation or a Fast Fourier Transform on dynamic balance strain gage signals, and ultimately computes aerodynamic coefficients. The dynamic balance converts sting motor rotation into pitch or yaw plane or roll axis oscillation, with timing information provided by a shaft encoder. Additional instruments control model attitude and balance temperature and monitor sting vibrations. Other instruments perform self-calibration and diagnostics. Procedures for conducting calibrations and wind-off and wind-on tests are listed.

Author

*Wind Tunnel Stability Tests; Wind Tunnel Apparatus; Dynamic Stability; Fourier Transformation; Strain Gages; Aerodynamic Coefficients; Demodulation*

**19970004374** Defence Science and Technology Organisation, Ship Structures and Materials Div., Melbourne, Australia

**Evaluation of a Portable Shock Tube for Function Testing of Air Blast Pressure Transducers**

Yiannakopoulos, George, Defence Science and Technology Organisation, Australia; Pleckauskas, Algis, Defence Science and Technology Organisation, Australia; Aug. 1996; 20p; In English

Report No.(s): DSTO-TR-0403; AR-009-813; Copyright; Avail: Issuing Activity (Defence Science and Technology Organisation, Melbourne, Australia), Hardcopy, Microfiche

Tests were conducted on a portable shock tube to study the pressure-time profile emanating from the open end of the tube and its suitability for function testing of pressure transducers in the field in situ. The pressure pulse was generated from a 0.22 calibre blank cartridge and a piezoelectric pressure transducer was used to record the signal. Comparisons were made between the pressure-time profiles generated by three types of cartridge representing three different pressure loadings. The shock tube was used in several mounting configurations, and tube design modifications were made to improve its performance. The resultant pressure profiles were compared to profiles generated from a starting pistol. Recommendations are made on the features of the pressure profile necessary for calibration and modifications are proposed which should enable these features to be produced.

Author

*Evaluation; Shock Tubes; Pressure Distribution; Recommendations*

## 11
## CHEMISTRY AND MATERIALS

*Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.*

**19970004393** Allied-Signal Aerospace Co., AlliedSignal Engines, Phoenix, AZ USA

**Durability Testing of Commercial Ceramic Materials** ***Final Report, Feb. 1978 - Dec. 1995***
Schienle, J. L., Allied-Signal Aerospace Co., USA; Jan. 1996; 430p; In English
Contract(s)/Grant(s): DEN3-27; RTOP 778-32-21
Report No.(s): NASA-CR-198497; NAS 1.26:198497; DOE/NASA/0027-1; E-10308; ASE-31-13043; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

Technical efforts by AlliedSignal Engines in DOE/NASA-funded project from February, 1978 through December, 1995 are reported in the fields ceramic materials for gas turbine engines and cyclic thermal durability testing. A total of 29 materials were evaluated in 40 cyclic oxidation exposure durability tests. Ceramic test bars were cyclically thermally exposed to a hot combustion environment at temperatures up to 1371 C (2500 F) for periods of up to 3500 hours, simulating conditions typically encountered by hot flowpath components in an automotive gas turbine engine. Before and after exposure, quarter-point flexure strength tests were performed on the specimens, and fractography examinations including scanning electron microscopy (SEM) were performed to determine failure origins.
Author
*Gas Turbine Engines; Ceramics; High Temperature Tests; Oxidation; Silicon Carbides; Silicon Nitrides; Flexural Strength; Thermal Cycling Tests*

## 12
## ENGINEERING

*Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.*

**19970003551** Universal Analytics, Inc., Torrance, CA USA
**ASTROS Enhancements, Volume 1, Astros User's Manual** ***Final Report, 15 Jan. 1987 - 30 Apr. 1995***
Neill, D. J., Universal Analytics, Inc., USA; Herendeen, D. E., Universal Analytics, Inc., USA; May 1995; 520p; In English; Limited Reproducibility: More than 20% of this document may be affected by poor print and microfiche quality
Contract(s)/Grant(s): F33615-87-C-3216; AF Proj. 2401
Report No.(s): AD-A308133; WL-TR-96-3004; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

ASTROS (Automated STRuctural Optimization System) is a computer program for the multidisciplinary design and analysis of aerospace structures. ASTROS combines mathematical optimization algorithms with traditional structural analysis disciplines such as static forces, normal modes, static aeroelasticity, and dynamic aeroelasticity (flutter), all in a finite element context, to perform automated preliminary design of an aircraft structure. This report is a complete user's manual that documents the many features of ASTROS through version 12 of the software package. It also provides information on system architecture and other topics of interest. This report is Volume 3 of a set; Volume 2 (WL-TR-93-3038) is the programmer's manual.
DTIC
*User Manuals (Computer Programs); Aircraft Structures; Structural Analysis; Architecture (Computers); Applications Programs (Computers); Algorithms; Finite Element Method; Computer Programs*

**19970003575** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, Jiangsu, China
**Transactions of Nanjing University of Aeronautics and Astronautics, Volume 11**
Zhang, Azhou, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Guo, Rongwei, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Yang, Zuosheng, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Zhu, Zhaodao, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Sun, Pingfan, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Xiong, Chunru, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; You, Lixin, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Xiaozhang, Zhang, Editor, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Transactions of Nanjing University of Aeronautics and Astronautics; May 1994; ISSN 1005-1120; Volume 11, No. 1; 123p; In English; Also announced as 19970003576 through 19970003593; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Topics presented include: A finite element method for solving generalized Stokes problems, calculation of three-dimensional boundary layer equations using differential quadrature method, method of evaluating aircraft torsional agility metric using pilot transfer function model, a method for calculating kinematic parameters of helicopters in loop and roll maneuvers, a variable parameter squeeze oil film damper, buckling analysis of polar orthotropic annular plates under uniform pressures, a parallel imagi-

nary EBE method for solving positive definite linear systems, on the construction of a Jacobi matrix from its spectrum and a submatrix, three aspects of ISAR signal processing, a new approach for ISAR translational motion compensation, variable structure model-following adaptive control design for robot manipulators, an investigation of hot film signals in locating boundary layer transition, and optical fiber sensor-based cutting force measuring device.
CASI
*Adaptive Control; Boundary Layer Transition; Finite Element Method; Optical Fibers; Robotics; Image Motion Compensation; Aircraft Maneuvers; Signal Processing; Synthetic Aperture Radar; Boundary Layer Separation*

**19970003591** Nanjing Univ. of Aeronautics and Astronautics, Nanjing, Dept. of Aerodynamics., Jiangsu, China
**An Investigation of Hot Film Signals on Locating Boundary Layer Transition**
Wang, Tiecheng, Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China; Transactions of Nanjing University of Aeronautics and Astronautics; May 1994; Volume 11, No. 1, pp. 110-113; In English; Also announced as 19970003575; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The abilities of several hot film signals, such as mean voltage, fluctuating voltage and oscillogram of voltage are comparatively studied to locate boundary layer transition. The features of these hot film signals are presented.
Author
*Boundary Layer Transition; Wind Tunnel Tests; Wind Tunnel Models; Angle of Attack; Reynolds Number; Signal Transmission*

**19970003707** SRI International Corp., Menlo Park, CA USA
**Characterization of Early Stages of Corrosion Fatigue in Aircraft Skin** ***Final Report, Sep. 1993 - 1995***
Schmidt, C. G., SRI International Corp., USA; Crocker, J. E., SRI International Corp., USA; Kanazawa, C. H., SRI International Corp., USA; Shockey, D. A., SRI International Corp., USA; Feb. 1996; 147p; In English
Report No.(s): AD-A307254; PYD-5082; DOT/FAA/AR-95/108; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

SRI International is conducting research to characterize and quantitatively describe the early stages of corrosion fatigue in the fuselage skin of commercial aircraft. Specific objectives are to gain an improved deterministic understanding of the transition from corrosion pit to short crack to long crack and to delineate the effects of environment, skin surface condition, and loading conditions on crack nucleation and propagation rates. This Phase I report summarizes the effort in the first two years of this five-year program. The results suggest that corrosion fatigue in Alclad 2024-T3 involves two competing crack nucleation mechanisms-hydrogen effects in the cladding and pitting at constituent particles in the core alloy. In a given situation, the mechanism which dominates depends on environment (particularly pH) and (weakly) on specimen orientation. Cracks do not necessarily nucleate at the largest corrosion pit, suggesting that the main effect of a pit is not to raise the local stress. Rather, a high local hydrogen concentration associated with accelerated corrosion at a pit could cause cracking in a nearby favorably oriented grain. Propagation rates of short cracks were slightly higher in acidic environments and in specimens with painted surfaces, but were unaffected by material orientation and surface roughness. Corrosion fatigue observations and data from the laboratory experiments are being compared wi th those from field components to check whether research results represent in-service experience.
DTIC
*Corrosion; Fuselages; Surface Properties; Crack Propagation; Commercial Aircraft; Cladding; Fatigue (Materials); Skin (Structural Member)*

**19970003709** Galaxy Scientific Corp., Egg Harbor Township, NJ USA
**Tire Test Correlation: Radial Versus Bias-Ply Tires**
Anderson, Rich, Galaxy Scientific Corp., USA; Mar. 1996; 32p; In English
Contract(s)/Grant(s): DTFA03-89-C-00043
Report No.(s): AD-A307536; DOT/FAA/AR-TN95/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The temperature performance of a radial tire was correlated with a bias ply tire of identical size under controlled laboratory dynamometer conditions. The general effects of increases in load and ground speed on the temperature profiles of each tire were compared. The results indicated that the bias ply tire used during the tests was more adversely affected by increases in load and speed than the radial tire. However, to further quantify the temperature profile distinction between the radial and bias ply tires, additional data and effort would be required.
DTIC
*Aircraft Tires; Aircraft Maintenance*

**19970004079** NASA Lewis Research Center, Cleveland, OH, USA

**Application of the k- omega turbulence model to quasi-three-dimensional turbomachinery flows**

Chima, Rodrick V., NASA Lewis Research Cent, USA; Journal of Propulsion and Power; November 1996; ISSN 0748-4658; 12, 6, pp. 1176-1179; In English; Copyright; Avail: Issuing Activity

In this study, an attempt is made to incorporate the low Reynolds number k- omega model in the quasi-three-dimensional turbomachinery analysis code. The k- omega model was implemented using many of Menter's recommendations and an implicit approximate-factorization scheme. The model was tested for a transonic compressor with rotation and variable stream-surface radius and height, and for a transonic turbine vane with transition and heat transfer. Results were compared to the B-L model and to experimental data.

Author (EI)

*Compressors; Mach Number; Mathematical Models; Navier-Stokes Equation; Reynolds Number; Turbomachinery; Turbulence*

**19970004231** Cornell Univ., Sibley School of Mechanical and Aerospace Engineering, Ithaca, NY USA

**Turbulent Inflow Measurements** ***Final Report, 5 Jul. 1995 - 31 Dec. 1996***

George, Albert R., Cornell Univ., USA; Dec. 31, 1996; 6p; In English

Contract(s)/Grant(s): NAG2-554

Report No.(s): NASA-CR-203038; NAS 1.26:203038; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the present research, tilt rotor aeroacoustics have been studied experimentally and computationally. Experimental measurements were made on a 1/12.5 scale model. A dimensional analysis showed that the model was a good aeroacoustic approximation to the full-scale aircraft, and scale factors were derived to extrapolate the model measurements to the full-scale XV-15. The experimental measurements included helium bubble flow visualization, silk tuft flow visualization, 2-component hot wire anemometry, 7-hole pressure probe measurements, vorticity measurements, and outdoor far field acoustic measurements. The hot wire measurements were used to estimate the turbulence statistics of the flow field into the rotors, such as length scales, velocity scales, dissipation, and turbulence intermittency. to date, these flow measurements are the only ones in existence for a hovering tilt rotor. Several different configurations of the model were tested: (1) standard configurations (single isolated rotor, two rotors without the aircraft, standard tilt rotor configuration); (2) flow control devices (the 'plate', the 'diagonal fences'); (3) basic configuration changes (increasing the rotor/rotor spacing, reducing the rotor plane/wing clearance, operating the rotors out of phase). Also, an approximation to Sikorsky's Variable Diameter Tilt Rotor (VDTR) configuration was tested, and some flow measurements were made on a semi-span configuration of the model. Acoustic predictions were made using LOWSON.M, a Mathematica code. This hover prediction code, from HOVER.FOR, used blade element theory for the aerodynamics, and Prandtl's Vortex theory to model the wake, along with empirical formulas for the effects of Reynolds number, Mach number, and stall. Aerodynamic models were developed from 7-hole pressure probe measurements of the mean velocity into the model rotors. LOWSON.M modeled a rotor blade as a single force and source/sink combination separated in the chordwise direction, at an effective blade radius. Spanwise, Mach-weighted integrals were used to find the equivalent forces and equivalent source strengths.

Derived from text

*Acoustic Measurement; Aerodynamic Characteristics; Flow Distribution; Flow Measurement; Scale Models; Tilt Rotor Aircraft*

**19970004235** NASA Langley Research Center, Hampton, VA USA

**Analytical Methodology for Predicting the Onset of Widespread Fatigue Damage in Fuselage Structure**

Harris, Charles E., NASA Langley Research Center, USA; Newman, James C., Jr., NASA Langley Research Center, USA; Piascik, Robert S., NASA Langley Research Center, USA; Starnes, James H., Jr., NASA Langley Research Center, USA; Nov. 1996; 27p; In English

Contract(s)/Grant(s): RTOP 538-02-10-01

Report No.(s): NASA-TM-110293; NAS 1.15:110293; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA has developed a comprehensive analytical methodology for predicting the onset of widespread fatigue damage in fuselage structure. The determination of the number of flights and operational hours of aircraft service life that are related to the onset of widespread fatigue damage includes analyses for crack initiation, fatigue crack growth, and residual strength. Therefore, the computational capability required to predict analytically the onset of widespread fatigue damage must be able to represent a wide range of crack sizes from the material (microscale) level to the global structural-scale level. NASA studies indicate that the fatigue crack behavior in aircraft structure can be represented conveniently by the following three analysis scales: small three-dimensional cracks at the microscale level, through-the-thickness two-dimensional cracks at the local structural level, and long cracks at the global structural level. The computational requirements for each of these three analysis scales are described in this paper.

Author

*Fuselages; Residual Strength; Crack Initiation; Crack Propagation; Fatigue (Materials); Computer Programs*

**19970004541** Lehigh Univ., Dept. of Mechanical Engineering and Mechanics., Bethlehem, PA USA

**Corrosion and Corrosion Fatigue of Airframe Materials** ***Final Report***

Wei, Robert P., Lehigh Univ., USA; Harlow, D. Gary, Lehigh Univ., USA; Feb. 1996; 56p; In English

Contract(s)/Grant(s): 92-G-0006

Report No.(s): AD-A307471; DOT/FAA/AR-95/76; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In support of the National Aircraft Research Program of the Federal Aviation Administration (FAA) Lehigh University undertook a multidisciplinary program of research to study corrosion and corrosion fatigue of airframe materials. The program is complemented by a program sponsored by the Air Force Office of Scientific Research (AFOSR). The objectives of these programs are: (1) the development of basic understanding of the processes of localized corrosion and corrosion fatigue crack nucleation and growth in high-strength aluminum alloys used in airframe construction; (2) the formulation of kinetic models for these elemental processes; and (3) the integration of these models into probabilistic models that can provide guidance in formulating methodologies for service-life prediction. This report summarizes research performed under the FAA sponsored (Phase 1) program for the period from 15 June 1992 to 14 June 1995. Experimental efforts during this period were focused upon (1) characterizations of the chemical microstructural and statistical aspects of pitting corrosion, and upon the kinetics of pitting of 2024-T3 aluminum alloy in aqueous environments; (2) establishment of the criteria for the transition from pitting to corrosion fatigue crack growth (i.e. crack nucleation); and (3) studies of corrosion fatigue crack growth (particularly in its early stage, or the so-called chemically short regime). The modeling effort, which cuts across the FAA and AFOSR programs, included the development and demonstration of a mechanistically based probability approach for service-life prediction and the formulation of a probability model for particle-induced corrosion pit growth that pertains to multiple-site-damage (MSD) analysis.

DTIC

*Corrosion; Airframes; Airframe Materials; Crack Propagation; Fatigue (Materials); Multidisciplinary Research; Aluminum Alloys; Microstructure*

## 15
## MATHEMATICAL AND COMPUTER SCIENCES

*Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.*

**19970003823** Naval Postgraduate School, Monterey, CA USA

**Design and Implementation of a NATOPS Qualification Database Management System for Naval Aviation Safety Officers**

Martin, Terryll R., Naval Postgraduate School, USA; Jun. 1996; 104p; In English

Report No.(s): AD-A313102; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The VFA-125 Safety Office located at NAS Lemoore is burdened with the enormous administrative responsibility of managing the NATOPS qualifications for over 200 pilots and passengers. During this period of military downsizing and operational funding cuts, this responsibility will require the increased attention of a smaller staff with a limited budget. The burden of paper file management could be eased through the introduction of automated record keeping while simultaneously increasing accuracy and efficiency. The potential for non-qualified personnel to fly squadron aircraft could be eliminated. Based on VFA-125 Safety Office requirements, this thesis designs and implements a database management system. The primary objective is to automate the currently utilized manual NATOPS filing system to allow the squadron Safety Officer immediate access to all NATOPS-related pilot qualification data. This system will store, sort and compare data relevant to all squadron pilots while minimizing the time spent verifying the previously-used manual filing system. Additionally, the staff will be able to query reports and generate memoranda with minimal effort. The system is also analyzed to determine possible enhancements in the future. The Aviation Safety Database System is designed using dBASE 3 Plus and dBASE for Windows 5.0.

DTIC

*Data Base Management Systems; Aircraft Safety; Data Bases; Flight Safety*

## 16
## PHYSICS

*Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.*

**19970003410** Boeing Commercial Airplane Co., Seattle, WA USA
**Definition of 1992 Technology Aircraft Noise Levels and the Methodology for Assessing Airplane Noise Impact of Component Noise Reduction Concepts**
Kumasaka, Henry A., Boeing Commercial Airplane Co., USA; Martinez, Michael M., Boeing Commercial Airplane Co., USA; Weir, Donald S., Garrett Turbine Engine Co., USA; Jun. 1996; 222p; In English
Contract(s)/Grant(s): NAS1-20090; RTOP 505-62-10-50
Report No.(s): NASA-CR-198298; NAS 1.26:198298; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report describes the methodology for assessing the impact of component noise reduction on total airplane system noise. The methodology is intended to be applied to the results of individual study elements of the NASA-Advanced Subsonic Technology (AST) Noise Reduction Program, which will address the development of noise reduction concepts for specific components. Program progress will be assessed in terms of noise reduction achieved, relative to baseline levels representative of 1992 technology airplane/engine design and performance. In this report, the 1992 technology reference levels are defined for assessment models based on four airplane sizes - an average business jet and three commercial transports: a small twin, a medium sized twin, and a large quad. Study results indicate that component changes defined as program final goals for nacelle treatment and engine/airframe source noise reduction would achieve from 6-7 EPNdB reduction of total airplane noise at FAR 36 Stage 3 noise certification conditions for all of the airplane noise assessment models.
Author
*Aircraft Noise; Noise Reduction; Transport Aircraft; Noise Spectra; Jet Aircraft*

**19970004076**
**Plasma generators for re-entry simulation**
Auweter–Kurtz, Monika, Universitaet Stuttgart, Germany; Kurtz, Helmut L.; Laure, Stefan; Journal of Propulsion and Power; November 1996; ISSN 0748-4658; 12, 6, pp. 1053-1061; In English; Copyright; Avail: Issuing Activity

The qualification of thermal protection systems (TPS) and numerical design tools for re-entry vehicles and space probes requires the ability to understand and duplicate the prevailing complex physico-chemical phenomena, including thermal and chemical nonequilibrium near the surface of a body that enters the atmosphere of the Earth or another celestial body. At the Institut fuer Raumfahrtsysteme of the University of Stuttgart, four plasma wind tunnels (PWK1-4) are in operation to simulate the thermal, aerodynamic, and chemical loads on the surface of a space vehicle. Three different plasma sources have been developed for this purpose: 1) a magnetoplasmadynamic generator for the simulation of the high-enthalpy and low-pressure environment during the first phase of re-entry, 2) a thermal arcjet device for the follow-on flight path at moderate specific enthalpies and higher stagnation pressures, and 3) an inductively heated generator for basic materials experiments over a wide range of specific enthalpies and pressures. Special efforts were made to avoid electrode erosion to preclude impairing the erosion and catalytic behavior of TPS materials. A detailed description of these plasma generators and an overview of the simulation regions and operation areas of the plasma wind tunnels are presented.
Author (EI)
*Computerized Simulation; Flight Paths; Plasma Generators; Plasmas (Physics); Reentry; Space Probes; Thermal Protection; Wind Tunnels*

**19970004375** Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia
**Assessment of Noise Levels In and Around the Sikorsky S-70A-9 Black Hawk Helicopter**
King, Robert B., Defence Science and Technology Organisation, Australia; Saliba, Anthony J., Defence Science and Technology Organisation, Australia; Creed, David C., Defence Science and Technology Organisation, Australia; Brock, Jeff R., Defence Science and Technology Organisation, Australia; Feb. 1996; 53p; In English
Report No.(s): DSTO-TR-0300; AR-009-621; Copyright; Avail: Issuing Activity (Defence Science and Technology Organisation, Melbourne, Australia), Hardcopy, Microfiche

This document reports the results of a comprehensive noise survey of the Sikorsky S-70A-9 Black Hawk helicopter environment and provides an assessment of the hearing protection devices worn by personnel exposed to this environment. Ambient noise levels were measured in the cabin of the Black Hawk at four positions under various flight conditions and at thirteen positions outside the Black Hawk under various ground running conditions. The attenuation properties of the ALPHA helmet, the Roanwell

MX-2507 Communications Headset and the EAR earplug were also assessed. Results show that these devices do not always provide enough hearing protection to meet current conservation regulations (DIG PERS 194), even when worn in combination. Recommendations relating to the use of these hearing protection devices and the maximum Permissible Daily Exposure Duration (PDED) for personnel exposed to the Black Hawk environment are made.
Author
*Noise Intensity; Aircraft Noise; Military Helicopters; H-60 Helicopter*

## 17
## SOCIAL SCIENCES

*Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.*

**19970003652** NASA Langley Research Center, Hampton,VA USA
**NASA Video Catalog**
1996; 138p; In English
Report No.(s): NASA-SP-7109(02); NAS 1.21:7109(02); No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This updated issue of the NASA Video Catalog lists 676 video productions from the NASA STI Database. Topics considered include: Aeronautics; Aerodynamics; Air Transportation and Safety; Aircraft Communication and Navigation; Aircraft Design, testing and Performance; Aircraft Instrumentation; Aircraft propulsion and Power; Aircraft Stability and Control; Research and Support Facilities; Astronautics; Ground Support Systems and Facilities; Launch Vehicles and Space vehicles; Electronic and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; Structural Mechanics; Energy Production; Environment Pollution; Meteorology and Climatology; Aerospace Medicine. Also included; Solid-State physics; Thermodynamics and Statistical Physics; and Space Radiation.
Derived from text
*Aerodynamics; Air Transportation; Aircraft Communication; Aircraft Safety; Aircraft Stability; Catalogs (Publications); Environment Pollution; Extraterrestrial Radiation; Flight Safety; Masers; Navigation; Photography; Quality Control; Support Systems*

## 19
## GENERAL

**19970004281** NASA Washington, Washington, DC USA
**Flights of Discovery: 50 Years at the NASA Dryden Flight Research Center**
Wallace, Lance E., NASA Washington, USA; 1996; 220p; In English; Original contains color illustrations
Report No.(s): NASA-SP-4309; NAS 1.21:4309; LC-96-15797; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
As part of the NASA History Series, this report (NASA SP-4309) describes fifty years of aeronautical research at the NASA Dryden Flight Research Center. Starting with early efforts to exceed the speed of sound with the X-1 aircraft, and continuing through to the X-31 research aircraft, the report covers the flight activities of all of the major research aircraft and lifting bodies studied by NASA. Chapter One, 'A Place for Discovery', describes the facility itself and the surrounding Mojave Desert. Chapter Two, 'The Right Stuff', is about the people involved in the flight research programs. Chapter Three, 'Higher, Faster' summarizes the early years of transonic flight testing and the development of several lifting bodies. Chapter Four, 'Improving Efficiency, Maneuverability & Systems', outlines the development of aeronautical developments such as the supercritical wing, the mission adaptive wing, and various techniques for improving maneuverability fo winged aircraft. Chapter 5, 'Supporting National Efforts', shows how the research activities carried out at Dryden fit into NASA's programs across the country in supporting the space program, in safety and in problem solving related to aircraft design and aviation safety in general. Chapter Six, ' Future Directions' looks to future research building on the fifty year history of aeronautical research at the Dryden Flight Research Center. A glossary of acronyms and an appendix covering concepts and innovations are included. The report also contains many photographs providing a graphical perspective to the historical record.
CASI
*Aircraft Design; Research Aircraft; Lifting Bodies; Aerodynamic Configurations; Research Facilities; Flight Tests; Histories; NASA Programs*

# Subject Term Index

# Personal Author Index

## X



## Y



## Z

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